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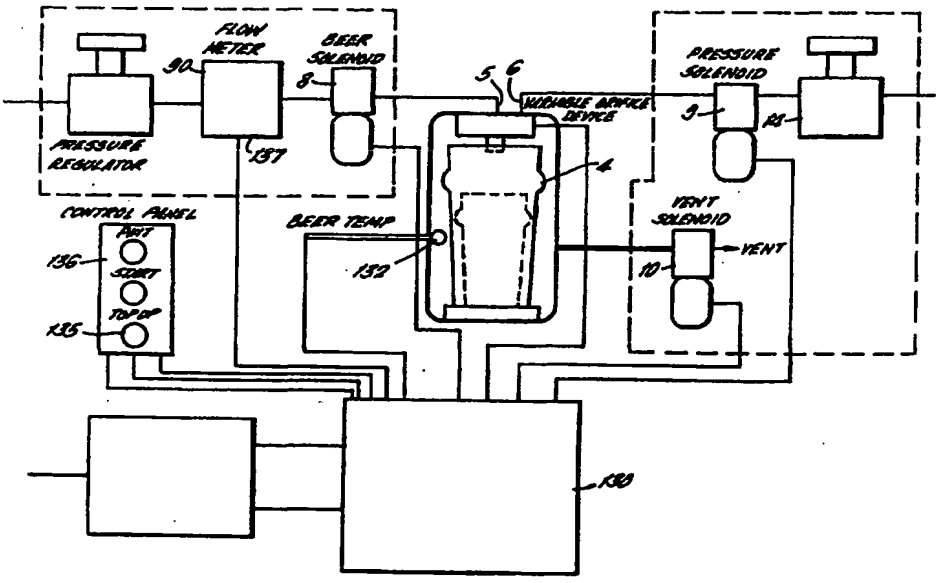


(57) Abstract

Apparatus for dispensing a beverage, for example beer, into a container, for example, a beer glass, includes a chamber, beverage inlet means, fluid inlet means and fluid outlet means, all in communication with the chamber. The chamber is pressurisable before, and/or during dispensation of the beverage. In another aspect, the apparatus may include a piezoelectric transducer coupled to a dispense nozzle for inducing turbulence in a flow of beverage in the apparatus. The piezoelectric transducer expands and contracts in response to electrical signals to cause the dispense nozzle to vibrate.

IMPROVEMENTS IN THE DISPENSING OF BEVERAGES

The present invention relates to a system that enables beverages with high levels of gassing to be dispensed with a smooth creamy head.

Many beverages, such as, beers, ales, lagers, stouts, wines, ciders and soft drinks are gassed by dissolving a gas such as carbon dioxide, or a mixture of carbon dioxide and an inert gas, in the beverage during production. Other beverages, for instance, milk and milkshakes, may be gassed in a similar manner. When dispensed, the dissolved gas comes out of the solution as the beverage is depressurised thereby forming bubbles in the beverage that, in turn, seed and nucleate other bubbles that rise to the top of the beverage forming a head. Ideally, the head should be close-knit and creamy in order to maximise the longevity of the head and its aesthetic appeal and feel on the mouth of the drinker.

Throughout this description, unless otherwise stated, references to carbonation and carbonated product should not be taken to refer to gassing by carbon dioxide alone, but should include gassing by other suitable inert gasses such as nitrogen, nitrous oxide or mixtures of any of said suitable gases.

Also throughout the description, unless otherwise stated, references to a beverage or beverages should not be read as restricted to any particular beverage but include any beverage having a gas dissolved therein wherein a proportion of the gas is designed to come out of solution prior to consumption.

Carbonated beverages are conventionally dispensed, for instance, in bars and public houses, by means of a dispense tap connected to a pressurised keg or other container in which the beverage is stored. The quantity and quality of the head formed on the beverage depend on many factors including the pressure of the beverage, temperature of the beverage, angle of dispensing and ambient conditions at the point of dispensation. Conventional methods of dispensing beverages work well for beverages having a low or medium level of carbonation with or without mixtures of other gases such as nitrogen. However, beverages having higher levels of carbonation, for instance lagers with greater than approximately 2.0 volumes of carbon dioxide, cannot presently be dispensed in this manner with a smooth creamy head since the gases in the beverage are significantly above their saturation point for the ambient conditions. Consequently, when the beverage is dispensed, a large proportion of the carbon dioxide is released spontaneously resulting in the beverage having a "flat" taste and appearance. The spontaneous release of gas under these conditions is not conducive to forming the dispersion of small bubbles necessary to form a close-knit creamy head. In addition, the spontaneous release of the gas may result in the beverage over-foaming and spilling over the top of the glass, leading to a waste of the product.

It is therefore an object of the present invention to provide a system that enables beverages, especially those with higher carbonation levels, to be dispensed with a long-lasting creamy head while retaining an adequate proportion of the gas in

solution in the beverage. It is another object of the present invention to provide a method of dispensing a high carbonation beverage to produce a long-lasting creamy head which produces "lacing" of the head down the sides of the glass as the beverage is consumed, which has been found to be desired by customers.

The present invention discloses apparatus for dispensing a beverage into a container, the apparatus comprising a chamber; beverage inlet means in communication with the chamber; fluid inlet means in communication with the chamber; and fluid outlet means in communication with the chamber; wherein the chamber is pressurisable before and/or during dispensation of the beverage.

Preferably the chamber is pressurisable before and/or during dispensation of the beverage by means of fluid influx through the fluid inlet means.

Preferably the chamber comprises a body portion, having an aperture therein for receiving therethrough the container; a base; and a door movable from a first position in which the aperture is open to a second position in which the aperture is closed; the body portion, base and door in the second position defining a closed volume within the chamber; wherein the chamber is pressurisable by influx of fluid into the volume.

Typically the fluid is a gas.

Preferably the gas is ambient air.

Alternatively the gas is nitrogen, carbon dioxide

or nitrous oxide.

Alternatively the gas is a mixture of two or more of the following: ambient air, nitrogen, carbon dioxide and nitrous oxide.

Preferably the gas is pumped into the chamber.

Alternatively the fluid is a liquid.

Preferably the liquid is water.

Preferably the volume comprises a secondary chamber in fluid communication with the chamber; wherein the chamber is pressurisable by the influx of liquid into the secondary chamber.

Preferably the secondary chamber surrounds a portion of the chamber.

Preferably the chamber comprises sealing means between the door and the body portion.

Preferably the sealing means comprises a gasket between an external face of the door and an internal face of the body portion.

It is desirable that the gasket is rubber.

Alternatively the gasket is polymer.

Preferably the body portion comprises a transparent window.

For safety reasons it is preferred that the

window is toughened glass.

Alternatively the window is polycarbonate.

Optionally the window comprises etchings.

In a first embodiment the body portion comprises retaining means for retaining the door in the second position during dispensation of the beverage.

Preferably the body portion comprises substantially vertical runners; the door being movable along the runners from the first position in which the door is lowermost to the second position in which the door is uppermost in sealing engagement with the body portion.

Preferably the door comprises an aluminum frame surrounding a polycarbonate panel.

In a second embodiment the door comprises a flat external face and a ribbed internal face; the door being flexible from the first position in which the door is sealed against the body portion and the second position in which the door is distorted into the chamber to open the aperture.

Preferably the door is joined to the body portion along a vertical edge of the door such that the door is flexible in a horizontal plane.

Preferably the door comprises reinforcing bars within ribs of the ribbed internal face.

Optionally the door is a plastic extrusion.

In a third embodiment the door is rotatable about a central vertical axis of the body portion from the first position to the second position.

Preferably the body portion comprises circumferential runners; the door sliding along the runners from the first position to the second position.

Preferably the door comprises an aluminum frame surrounding a polycarbonate panel.

Preferably edge portions of an external face of the door seal against an internal face of flange extensions of the body portion when the door is in the second position.

It is desirable that the door comprises a handle.

In a fourth embodiment the chamber comprises a body portion, having an aperture therein for receiving therethrough the container; a base; an internal portion movable from a first position in which the aperture is open to a second position in which the aperture is closed; and a piston located within the internal portion; the body portion, base, internal portion in the second position and piston defining a closed volume within the chamber; wherein the chamber is pressurisable by movement of the piston.

Preferably the internal portion comprises a cylinder of smaller diameter than the body portion and axially aligned therewith; the piston located within the cylinder; wherein the cylinder is axially movable relative to the body portion from the first position

in which the cylinder is below the level of the aperture to the second position in which the cylinder is sealed against a top portion of the body portion closing the aperture.

Preferably the cylinder comprises a circumferential circlip; the piston comprises an O-ring in rolling sealing engagement with the cylinder; and a compression spring is located between the circlip and the piston such that as the piston is moved upwardly in the chamber the cylinder is forced upwardly into the second position.

Preferably the top portion of the body portion comprises a rubber seal against which the cylinder seats in the second position.

Preferably the piston is coupled to gearing means and a lever.

Optionally the piston is coupled to an electric ram.

In a fifth embodiment the chamber comprises the container; and the chamber is pressurisable by influx of fluid into the container.

Preferably the beverage inlet means; fluid inlet means; and fluid outlet means are coupled to the container by means of a manifold.

It is preferred that the beverage inlet means comprises a beverage inlet valve; the fluid inlet means comprises a fluid inlet valve; and the fluid outlet means comprises a fluid outlet valve.

Optionally the beverage inlet valve, fluid inlet valve and fluid outlet valve comprise manual valves.

Alternatively the beverage inlet valve, fluid inlet valve and fluid outlet valve comprise electrical valves.

Alternatively the beverage inlet valve, fluid inlet valve and fluid outlet valve comprise electrical in-line solenoid valves.

Alternatively the beverage inlet valve, fluid inlet valve and fluid outlet valve comprise electromechanical valves.

Alternatively the beverage inlet valve, fluid inlet valve and fluid outlet valve comprise pneumatic valves.

Alternatively the fluid outlet valve comprises the seal between the door and the body portion of the chamber.

Optionally the beverage inlet means comprises a smooth flow stainless steel dispense tap.

Optionally the beverage inlet means comprises turbulence generating means.

Optionally the turbulence generation means comprises an orifice plate.

In one version the turbulence generation means comprises means for injecting a secondary flow of beverage into the beverage in the beverage inlet

means.

In another version the turbulence generation means comprises means for injecting a flow of gas into the beverage in the beverage inlet means.

In a third version the turbulence generation means comprises a fluidic valve.

In a further version the turbulence generation means comprises means for vibrating a dispense nozzle of the beverage inlet means at high frequencies.

Preferably the means for vibrating the dispense nozzle comprises an piezo-electric transducer coupled to the dispense nozzle; wherein the piezo-electric transducer expands and contracts in response to electrical signals to cause the dispense nozzle to vibrate.

Preferably the dispense nozzle is vibrated at ultrasonic frequencies.

Optionally the beverage inlet means comprises a single dispense nozzle.

Alternatively the beverage inlet means comprises a multiplicity of dispense nozzles.

Optionally the present invention comprises metering means for accurately dispensing known volumes of beverage.

Preferably the metering means is located in the beverage inlet means.

Optionally the metering means comprises a positive displacement pump.

Alternatively the metering means comprises a turbine meter.

Alternatively the metering means comprises a weight sensor that determines the weight of beverage dispensed.

Alternatively the metering means comprises a pressure sensor that determines the change in pressure of the chamber as the beverage is dispensed.

Alternatively the sensing means comprises one or more photo-electric diodes arranged transversely across the chamber.

The present invention also discloses apparatus for inducing turbulence in a flow of beverage comprising a piezo-electric transducer coupled to a dispense nozzle; wherein the piezo-electric transducer expands and contracts in response to electrical signals to cause the dispense nozzle to vibrate.

The present invention further disclose a method of dispensing a beverage comprising the steps of: inserting a container into a chamber through an aperture; closing the aperture to seal the chamber; pressurising the chamber to a known pressure before dispensing the beverage; dispensing the beverage; depressurising the chamber; and opening the aperture to allow the container and beverage to be removed.

The present invention yet further discloses a

method of dispensing a beverage comprising the steps of: inserting a container into a chamber through an aperture; closing the aperture to seal the chamber; dispensing the beverage thereby causing the pressure in the chamber to increase; depressurising the chamber; and opening the chamber to allow the container and beverage to be removed.

Preferably the chamber is pressurised by the influx of fluid.

Preferably the fluid is a gas.

Preferably the gas is ambient air.

Alternatively the gas is nitrogen.

Alternatively the gas is a mixture of two or more of the following: ambient air, carbon dioxide, nitrogen and nitrous oxide.

Alternatively the chamber is pressurised by movement of a piston.

Optionally the chamber is pre-pressurised to a pressure in the range 0 to 45 kPa.

Preferably the chamber is pre-pressurised to a pressure in the range 10 to 30 kPa.

Optionally the chamber is pressurised to a pressure in the range 20 to 140 kPa.

Optionally the beverage is dispensed at a temperature in the range 2 to 10 degrees Celsius.

Preferably the beverage is dispensed at a temperature in the range 3 to 6 degrees Celsius.

Preferably the beverage is dispensed at a temperature within half a degree Celsius of a known temperature.

Embodiments of the present invention will now be described, by way of example only, with reference to the following drawings, of which:

Figure 1 is a schematic drawing of the apparatus of the present invention;

Figure 2a is a perspective view of a first embodiment of the present invention;

Figure 2b is a rear view of a first embodiment of the present invention;

Figure 3a is a perspective view of a second embodiment of the present invention;

Figure 3b is a rear view of a part of a second embodiment of the present invention;

Figure 4 is a perspective view of a third embodiment of the present invention;

Figure 5a is a cross-sectional view of a part of the present invention;

Figure 5b is a schematic drawing of an embodiment of the present invention;

Figure 5c is a schematic drawing of an embodiment of the present invention;

Figure 6 is a perspective view of a fourth embodiment of the present invention;

Figure 7 is a perspective view of a component of the present invention;

Figure 8 is a cross-sectional view of a component of the present invention;

Figure 9 is a cross-sectional view of a prior art python;

Figure 10 is a cross-sectional view of a component of the present invention;

Figure 11 is a cross-sectional view of a component of the present invention.

The apparatus 1 of the present invention comprises a dispense head 2, a fluid supply means 14, beverage transport means 13 and beverage storage means 12.

As shown in Figure 1, the dispense head 2 comprises a chamber 3, a beverage inlet 5, a fluid inlet 6, a fluid outlet 7, a beverage inlet valve 8, a fluid inlet valve 9 and a fluid outlet valve 10. The chamber 3 defines a volume 11 that may be opened to allow the insertion and removal of a container 4 and closed to allow pressurisation of the chamber 3.

The container 4 may be of any volume that fits within the dispense head 2. Preferably the container 4 has a volume of half a pint (284ml) or one pint (568ml). The container 4 may be of any shape but is preferably manufactured from glass or a metal. The container may be a glass which is lined or stamped to certify the volume contained therein. Plastic materials may also be used.

A first embodiment of the chamber 3 is shown in Figures 2a and 2b. The chamber 3 comprises a main body 20 and a base 22. The base 22 is attached to the main body 20 by means of screws. Alternatively an adhesive may be used to bond the base 22 to the main body 20. The main body 20 contains a front opening 42

in which a window 21 is inserted and a rear opening 41 through which the container 4 may be inserted and removed. A door 30 is provided to seal in use the rear opening 41. The main body 20 may additionally comprise struts to strengthen the chamber 3 and allow a greater proportion of the chamber 3 surface to be given over to the window 21. This may be desired for aesthetic reasons to allow customers to more clearly see the dispensation process. The door 30 comprises an aluminium frame 31 around a polycarbonate or reinforced glass window 33. The door slides in a vertical plane on runners 34 attached to the main body 20. The door 30 seals against the main body 20 when in the closed position. Preferably the door 30 moves internally of extensions 43 of the main body 20. The edge portions of the door 30 seal in face to face contact with the extensions 43 of the main body 20. The integrity of the seal may be improved by including a rubber or polymer gasket between the door 30 and extensions 43. The gasket can be fixed to either a rear face of the door 30 or an internal face of the extensions 43. An advantage of the door 30 seating against the internal surface of the extensions 43 is that as the pressure in the chamber 3 increases the seal between the door 30 and extensions 43 is improved; therefore there is no tendency for the door 30 to become separated from the main body 20 as the internal pressure increases. The door 30 is provided with a handle 32 to allow the door 30 to be raised and lowered manually into and out of the sealed position. Preferably the width of the door 30 is sufficient to allow a user of the dispense head 2 to easily insert his hand into the chamber 3 to grip and withdraw the container 4. Retaining means, such as conventional catches are provided on the runners 34 to retain the

door 30 in the closed, uppermost position when the dispense head 2 is in use. The retaining means may be connected to an interlock to prevent operation of the dispense head 2 when the door is not in the closed position. Additionally a pressure sensitive interlock may be used to prevent opening of the door 30 whilst the chamber 3 is at above-atmospheric pressure. The door 30 is provided with a burst panel 35 to prevent pressure overload of the chamber 3.

The main body 20, window 21, base 22 and door 30 together define the volume 11 of the chamber 3. The main body 20 and base 22 may be manufactured from either aluminium or Mazac and are preferably formed by high pressure die casting. The base 22 preferably comprises a support means for locating the container 4 in the correct orientation for dispensation of the beverage. This support means may be in the form of a recessed portion 140 of the inside of the base 22 in which the container 4 rests, or in the form of a raised annular ring in which the container 4 is inserted. Preferably the recessed portion contains different depths of recess for receiving half and one pint containers 4. The support means also serves the function of supporting the container 4 during dispensation of the beverage since the container 4 is not able to be supported by hand. The window 21 is formed from clear polycarbonate or, alternatively, may be manufactured from toughened glass and it is essential that the window is able to withstand high pressures and impacts. The window 21 is sealed against the main body 20 using silicon putty. A transparent window is preferred to allow customers to watch the dispensation of beverages. Optionally the window 21 may have designs etched therein or have

decals applied thereto for aesthetic reasons. An external drip tray may be positioned beneath a sump 26 of the base 22. The sump 26 allows for draining of the chamber 3 to remove spilt beverage. A sump valve closes the sump 26 during pressurisation of the chamber 3. The external drip tray may be manufactured by injection moulding in acetal. Optionally, a cowl 24 and skirt 25 may be fixed to the main body 20 and base 22. The cowl 24 and skirt 25 allow the dispense head 2 to take many external shapes and forms for aesthetic, ergonomic and advertising reasons. The cowl 24 and skirt 25 are also preferably manufactured from aluminium or Mazac but may be formed from other materials. A clamp screw passes downwardly through the base 22 and is coupled to a clamp pad The clamp pad and clamp screw allows the base 22 to be clamped to a bar top or bench. The dispense head 2 may be positioned behind the line of the bar or on top of the bar providing that the plane of the door 30 is clear of the rear of the bar to allow the door 30 to be lowered to access the chamber 3. An advantage of clamping the dispense head 2 to the bar is that no drilling of the bar top is required. This results in cheaper and quicker installation and flexibility in moving or uninstalling the dispense head 2.

Optionally, the chamber 3 may be provided with lighting means such as a light bulb or fluorescent tube to illuminate the container 4 and chamber 3 during dispensation of the beverage.

Preferably the external width and height of the dispense head 2 does not exceed 500mm and 800mm respectively.

A second embodiment of the chamber 3 is shown in Figures 3a and 3b. The main body 20, window 21 and base 22 are as described in the first embodiment. In this embodiment the rear opening 41 is closed by a flexible door 50. The rear face 51 of the flexible door 50 is smooth and the inside face 52 comprises vertical ribs 53 to allow the flexible door 50 to be folded back into the chamber 3 when access to the chamber 3 is required. The ribs 53 are reinforced with steel rods 54 which pass down the inside of each rib 53 to provide strength where they span the height of the opening 41 to prevent buckling of the door 30 when the chamber 3 is pressurised. A handle 32 allows the door to be pulled into the closed position prior to dispensation of the beverage. Similarly, to the first embodiment, a burst panel 35 is provided in the flexible door 50 to prevent pressure overload. Integral hinges 55 are provided on one side of the flexible door 50 opposite the handle 32 to allow attachment of the flexible door 50 to the main body 20. The flexible door 50 is manufactured from a plastic extrusion. A gasket may be provided at the interface between the door 30 and the main body 20 to improve the integrity of the seal.

A third embodiment of the chamber 3 is shown in Figure 4. The chamber 3 comprises a main body 20, window 21 and base 22 as in the previous embodiments. The window 21 is mounted sealingly in a front opening 110. A rear opening 111 is provided to allow the container 4 to be inserted and removed from the chamber 3. A sliding door 112 is provided, located within the main body 20 and rotatable about a central vertical axis of the chamber 3. The sliding door 112 rotates in one sense to seal the rear opening 111 and

close the chamber 3 and rotates in the opposite sense to open the chamber 3 and reveal the rear opening 111 to allow the container 4 to be inserted or removed. The sliding door 112 comprises a metal or plastic handle 113 that may be gripped manually to open and close the sliding door 112. When the sliding door 112 is fully closed there exists an overlap between the door 112 and main body 20 which provides a common flat surface, allowing a seal to be formed of high integrity. The main body 20 may have rubber or polymer seals disposed around the rear opening 111 to improve the efficiency of the seal between the sliding door 112 and main body 20. An advantage of the sliding door 112 seating against the internal surface of the main body 20 is that as the pressure in the chamber 3 increases the seal between the sliding door 112 and main body 20 is improved; therefore there is no tendency for the sliding door 112 to become separated from the main body 20 as the internal pressure increases. As with the previous embodiments of chamber 3 a burst panel may be provided in the door to prevent dangerous over-pressurisation of the chamber 3.

Embodiments one to three of the chamber 3 comprise a beverage inlet valve 8, fluid inlet valve 9 and fluid outlet valve 10. These valves may be operated manually or automatically. Automatic valves may be electrical, electromechanical or pneumatic. Alternatively, the fluid outlet valve 10 may comprise the seal of the chamber 3. In this case, release of fluid is achieved by unsealing the chamber 3 by, for instance, opening the door 30, flexible door 50 or sliding cylinder 72.

An advantage of manual valves are their ease of

use, low cost and reliability. The advantages of electronic, electromechanical and pneumatic valves is the ability to control and vary the flux rate of beverage/fluid precisely and consistently.

The beverage inlet 5 may comprise a conventional dispensing tap or smooth flow stainless steel dispense tap as used for dispensing keg beers. Alternatively, the beverage inlet 5 may comprise a turbulence generating means. Turbulence generation in the flow of beverage is useful since it promotes the nucleation of small gas bubbles in the beverage flow. These bubbles then seed other bubbles as the beverage contacts the container 4 which rise to form the head. Nucleation of bubbles in the beverage before the beverage contacts the container 4 has been found to greatly increase the quantity and suitability of bubbles generated. Conventional turbulence generation means include orifice plates disposed in the flow path of the dispensing tap. An orifice plate typically comprises 4 to 12 holes, each hole typically being 0.4 to 2 millimetres in diameter. Orifice plates for dispensing beverages such as beers normally comprise 4 to 8 holes, each hole being 0.6 to 1.1 millimetres in diameter. Beverage passing through the orifice plate is forced into a turbulent motion encouraging the nucleation of bubbles in the beverage.

The present invention discloses the injection of gas into the flow to induce turbulence in the beverage. The gas may be the same gas used to pressurise the chamber 3 or a different gas. The gas may be the same gas used to carbonate the beverage. Alternatively, a secondary flow of beverage may be jetted into the primary beverage flow to form

turbulence, or a fluidic diode incorporated in the beverage inlet 8 to induce turbulence.

Electromechanical vibration of the nozzle of the dispense tap also produces a suitable dispersion of bubbles in the beverage flow. It has been found that ultrasonic frequencies may be successfully used to vibrate the flow of beverage to nucleate bubbles. One means of using ultrasound to vibrate the beverage is shown in Figure 5a. A dispense tap 80 is provided with an in-line solenoid 81 acting as the beverage inlet valve 8 and a piezo-electric transducer 84. The solenoid 81 is used to control the volume flow rate of beverage. Beverage 82 enters the dispense tap 80 and passes through a central passageway 86 past the in-line solenoid 81 into a valve chamber 87. Beverage then passes through a secondary passageway 88 before exiting the dispense tap through a nozzle outlet 89. The piezo-electric transducer 84 is positioned surrounding the secondary passageway 88. Preferably, the piezo-electric transducer 84 is positioned close to the nozzle outlet 89 to accentuate the vibration of the beverage. In use, the piezo-electric transducer 84 is vibrated at ultrasonic frequencies by applying an electric voltage across the transducer 84. The resulting expansion and contraction of the piezo-electric transducer 84 causes the secondary passageway 88 to vibrate which in turn vibrates the beverage flowing through the secondary passageway 88. Altering the frequency and/or amplitude and/or pattern of operation of vibration of the piezo-electric transducer 84 provides a means for altering the frequency and/or amplitude and/or pattern of vibration of the secondary passageway 88. This variability allows for differing amounts and types of bubbles to

be nucleated. It has been found that vibrating the secondary passageway 88 at ultrasonic frequencies allows for a substantial nucleation of bubbles in the dispensing beverage. The piezo-electric transducer 84 is also advantageous in that the amplitude and frequency of vibration can be easily controlled and even varied during the dispensing cycle if required. For instance, it may be desired only to seed bubbles in the flow of beverage at the beginning and/or end of the dispensing cycle, or to vibrate the secondary passageway 88 in a regular or irregular series of short bursts. The control of the transducer 84 may be manual, operated by the user of the apparatus, or automatic, responding to sensor readings from the dispense head. Relevant variables which could be sensed and used to adapt the vibration characteristics include the temperature of the beverage, level of gassing of the beverage and the degree of gas break-out during dispensation.

The nozzle of Figure 5a may be used separate from the dispense head 2 here described as a means of inducing turbulence in a flow of beverage from any conventional tap.

The nozzle outlet 89 may be a single outlet or may alternatively have multiple outlets. The nozzle outlet or outlets 89 may be shaped so as to dispense the beverage in a particular pattern. This might be, for instance, a fan shape or a spray of beverage. The nozzle outlet 89 may also be directed towards different positions in the container 4 to produce different amounts of turbulence generation in the beverage as the beverage contacts the container 4. For example, the nozzle outlet 89 may be directed into

the centre of the container 4 or alternatively to one side of the container 4 or alternatively may be designed to vary the direction of dispensation during the dispensation cycle.

As shown schematically in Figure 5b the beverage inlet 5 includes a metering means 90 at a position upstream of the beverage inlet valve 8. The purpose of the metering means 90 is to ensure that measures of beverage are dispensed accurately and consistently. The metering means 90 may be of a type that is calibrated to meet legal requirements for accuracy of volume dispensed or may alternatively be of a non-calibrated type. In cases where the metering means 90 is not of a type to meet legal requirements regarding the quantity of measures dispensed, the dispense head 2 is provided with an additional beverage inlet 91 that serves as a top-up means. Once the initial dispensation of beverage through the dispense tap 80 has finished, the additional beverage inlet 91, together with a pinch valve 92 which bypasses the beverage inlet valve 8, may be utilised to top-up the level of beverage in the container 4 to the required amount.

The metering means 90 may comprise a positive displacement peristaltic pump, a turbine meter or another conventional meter.

Alternatively as shown in Figure 5c, the control of the quantity of beverage dispensed may be achieved by means of a sensing means 93 remote from the dispense tap 80. The sensing means 93 may be a gravimetric sensor which detects the weight of beverage dispensed. Calibration of the gravimetric

sensor allows for the dispensation of beverage to stop when the weight of beverage in the container 4 equals the expected weight of either a half or one pint measure of the beverage. Alternatively, the sensing means 93 may comprise a pressure detection sensor. As beverage is dispensed into the chamber 3, the pressure within the chamber 3 rises since the chamber 3 is sealed such that the volume 11 is closed. The rise in pressure in the chamber 3 is proportional to the volume of beverage dispensed. Thus, a sensor measuring the pressure within the chamber 3 may be used to detect when either a half pint or one pint measure of beverage has been dispensed. Another alternative as a sensing means 93, is a photoelectric diode aligned transversely across the chamber 3. With this arrangement, the rising level of the surface of the beverage within the container 4 obscuring the reflector of the photoelectric diode from the emitter produces a change in signal within the photoelectric diode which may be used to stop the flow of beverage through the dispense tap 80. Correct alignment of the photoelectric diode therefore allows the dispensation of beverage to stop when the level of beverage within the container 4 equates to a half pint or one pint measure of beverage having been dispensed. Two diodes may be utilised, one for half pint measures and the other for one pint measures.

The fluid inlet valve 9, similarly to the beverage inlet valve 8 may be manual or automatic, electrical, electromechanical or pneumatic. Preferably the fluid inlet valve 9 is a solenoid controlled automatically. The solenoid may be positioned in the base 22 or main body 20. Preferably the solenoid is located in the base 20. This has the advantage that

fluid feed pipes are not required in the main body 20 which would increase the size of the main body 20 and interfere with the view through the window 21. A solenoid fluid inlet valve 9 allows for precise, variable fluid flow into the chamber 3.

Similarly the fluid outlet valve 10 is preferably a solenoid. Alternatively the fluid outlet valve 10 may be the seal formed between the door 30, flexible door 50 or sliding door 112 and the main body 20. The fluid outlet valve 10 is closed when the chamber 3 is sealed by closing the door 30, flexible door 50 or sliding door 112 and opened when the door 30, flexible door 50 or sliding door 112 is opened. A disadvantage with this type of fluid outlet valve 10 is the lack of control over the rate of fluid flow from the chamber 3, which is why the use of a solenoid is preferred.

An essential feature of the dispense head 2 is the ability to pressurise the chamber 3 before and/or during dispensation of the beverage. The chamber 3 may be pre-pressurised before dispensation begins or simply sealed and held at zero gauge pressure. The pressure within the chamber 3 may be held constant during dispensation of the beverage or may be allowed to rise or fall as dispensation proceeds. The depressurisation of the chamber 3 may be at a controlled rate or instantaneous. Where the chamber 3 is as described in the first, second or third embodiments above, pressurisation and/or pre-pressurisation of the chamber 3 is achieved via fluid entering the chamber 3 via the fluid inlet 6. Preferably the fluid is a gas. Preferably, the fluid supply means 14 comprises an air pump local to the dispense head 2. Alternatively the air pump may be

located remote from the dispense head 2 and connected to the chamber 3 via piping. In this way a single air pump may supply pressurised gas to multiple dispense heads 2. The air pump pumps gas into the chamber 3. The gas may be ambient air or gas from an external cylinder such as nitrogen, carbon dioxide or other inert gases. A mixture of gases may also be used.

Alternatively, pressurisation or pre-pressurisation of the chamber 3 may be achieved by partially filling the chamber 3 with liquid. Preferably, the liquid is water. The chamber 3 defines a closed volume 11 during dispensation of the beverage. Consequently water entering the chamber 3 will cause the pressure in the remainder of the chamber 3 to increase in proportion to the quantity of water which has entered the chamber 3. The water may be directed into the chamber 3 so as to directly surround the container 4 or may alternatively be directed into a secondary chamber, the secondary chamber being in fluid communication with the chamber 3. Preferably, the secondary chamber is annular, formed surrounding the chamber 3 with clear walls which allow the filling of the secondary chamber to be seen through the window 21. This may be used for various aesthetic affects, together with lighting and advertising decals. Where liquid is used to pressurise the chamber 3, depressurisation is affected by draining the liquid from the secondary chamber or chamber 3. Preferably the liquid drained from the dispense head 2 is retained in a closed circuit of the fluid supply means 14 and re-used for the next dispensation cycle. This is advantageous in reducing the quantity of liquid required to operate the dispense head 2.

A fourth embodiment of the chamber 3 is shown in Figure 6. The chamber 3 comprises a main body 60, top cap 61, drip tray 62, piston 63, pneumatic ram, base 65 and a lever 66.

The main body 60 is formed from an aluminium extrusion and comprises front and rear openings 67, 68. A polycarbonate window may be positioned in the front opening 67 sealed against the main body 60 by silicon putty. The rear opening 68 is left open allowing access to the chamber 3 to insert and remove the container 4.

The top cap 61 is manufactured from either aluminium or Mazac and is formed by sand casting or other suitable means. The top cap 61 incorporates a rubber seal on an internal surface.

A cylindrical sliding cylinder 72 of smaller diameter than the main body 60 is located coaxially with the main chamber 60 and movable relative to the main chamber 60 upon operation of the lever 66.

The sliding cylinder 72 is manufactured from clear polycarbonate or toughened glass. The top and bottom of the sliding cylinder 72 are provided with rings 75 manufactured from stainless steel. Grooves are provided on the outside of the rings 75, coated with PTFE to act as bearings against the main body 60. The piston 63 is located internally of the sliding cylinder 72 and comprises an O-ring to provide an effective seal between the piston 63 and the sliding cylinder 72. A connecting rod is welded between the piston 63 and pneumatic ram. The pneumatic ram is electrically driven and runs on linear bearings

attached to the base 65. The sliding cylinder 72 further comprises a steel ring or circlip approximately halfway along its axial length. A spring positioned between the circlip and the piston 63 ensures that the sliding cylinder 72 moves axially upwards relative to the main body 60 when the lever 66 is operated. With the chamber 3 in the open position, the sliding cylinder 72 rests beneath the level of the front and rear openings 67, 68 of the main body 60 to allow insertion or removal of the container 4. The chamber 3 is closed by operating the lever 66 which, via gearing means, causes the piston 63 to move upwardly within the main body 60. The sliding cylinder 72 moves upwards until the top surface of the sliding cylinder 72 contacts the rubber seal of the top cap 61. Continued movement of the lever 66 urges the piston 63 upwardly towards the top cap 61. Force transmitted through the compressed spring to the circlip and sliding cylinder 72 ensures that the sliding cylinder 72 is firmly sealed against the top cap 61. In addition the continued movement of the piston 63 provides a means of pre-pressurising the chamber 3 by compressing the gas held in the now closed volume 11 within the sliding cylinder 72. The pneumatic ram is provided to enable further axial movement of the piston 63 towards the top cap 61. The pneumatic ram and piston 63 provide a means for pressurising the chamber 3. The pneumatic ram is activated when the lever 66 reaches a point equivalent to the sliding cylinder 72 being in the raised position sealing against the rubber seal and after the piston 63 has pre-pressurised the chamber 3.

The drip tray 62 is located within the chamber 3 and has the dual purpose of acting as a conventional

drip tray and as a location for the container 4. The drip tray 62 is suspended from the top cap 61 by means of a bracket. The drip tray 62 is preferably removable for emptying and cleaning. The drip tray 62 is manufactured from acetal and is preferably round in shape. The bracket is preferably manufactured from aluminium or stainless steel.

The base 65 serves to couple the dispense head 2 to a bar or worktop. The main body 60 and sliding cylinder 72 pass through the base 65. The dispense head 2 may be attached to the rear edge of a bar with the sliding components behind the line of the bar. Alternatively the dispense head 2 may be positioned on the bar with the sliding components moving through a hole formed in the bar. At the bottom of the base 65 there is provided gearing attached to the lever 66 which provides that the lever 66 when first pulled raises the sliding cylinder 72 into sealing engagement with the top cap 61 and then moves the piston 63 axially to provide partial pressurisation of the chamber 3 before actuating the pneumatic ram which pressurises the closed chamber 3. The base 65 is manufactured from either aluminium or Mazac.

The lever 66 is similar to a hand-pump with similar characteristics as regards the forces needed to operate it. However, the lever is attached to gearings so that partial pressurisation of the chamber 3 may be achieved without unacceptable force being required. The lever 66 is preferably able to rotate through 180° so that it may be moved into a position parallel to the edge of the bar, out of the way of bar staff during dispensation of the beverage.

Pressurisation of the chamber 3 of the fourth embodiment of chamber 3 described above is achieved by movement of the piston 63 within the sliding cylinder 72.

The beverage inlet 5 of the fourth embodiment is similar to the beverage inlet 5 of embodiments one to three described above.

The fluid inlet 6 and fluid outlet 7 of the fourth embodiment are provided by the opening between the sliding cylinder 72 and main body 60. The fluid inlet valve 9 and fluid outlet valve 10 are provided by the seal between the sliding cylinder 72 and the rubber seal 70 of the top cap 61. The fluid used with the fourth embodiment of the chamber 3 is a gas. Gas is free to enter the chamber 3 through the rear opening 68 whilst the sliding cylinder 72 is in the lowered position. In use, the lever 66 is operated and the sliding cylinder moves into sealing engagement with the top cap 61, closing the fluid inlet valve 9. The piston 63 then pressurises the gas in the chamber 3 after which the beverage is dispensed. When dispensation is complete the lever 66 is returned to its starting position causing the piston 63 to move downwardly within the sliding cylinder 72 depressurising the chamber 3 and causing the sliding cylinder 72 to lower to its starting position opening the fluid outlet valve 10.

In a fifth embodiment of the dispense head 2 the chamber 3 is provided by the container 4. The container 4 defines the closed volume 11. The beverage inlet 5, fluid inlet 6, fluid outlet 7, beverage inlet valve 8, fluid inlet valve 9 and fluid outlet valve 10

are provided on a manifold which is sealed in use against the container 4. Since the container 4 defines the chamber 3 the fluid used for pressurising the chamber must be a gas. The container 4 may include, for safety reasons, an impact resistant casing or sleeve to prevent injury if the container should break during pressurisation.

The operating cycle and operating conditions of the apparatus will now be described. The operating cycle begins when an empty container 4 is introduced into the apparatus 1 and finishes when the container 4 and beverage are removed from the apparatus 1.

It has been found from experiments that the quality and quantity of head formed on the beverage depends on a number of factors of the operating cycle. These factors include the gauge pressure within the chamber 3 before dispensation, the variation in gauge pressure within the chamber 3 during dispensation, the temperature within the chamber 3, the temperature of the beverage, the gas blend within the chamber 3, the gas within the beverage, the temperature of the container 4, the degree of turbulence generation by the turbulence generation means, the volume flow rate of beverage, the dwell time (the time the beverage is allowed to sit after dispensation has finished before depressurisation occurs), the quantity of beverage dispensed and the type of beverage dispensed. It has been found that beverages with high carbonation levels of the order of 2.0 to 3.0 volumes require the inclusion of at least a small proportion of nitrogen in order to produce a high quality, creamy head. For example, the inclusion of approximately 35 parts per million (ppm) of nitrogen in a beverage containing 1.0

volume of carbon dioxide, or 5 ppm or higher of nitrogen in a beverage containing 2.0 volumes of carbon dioxide has been found to significantly increase the quality of the head.

The operating cycle and operating conditions of the dispense head 2 may be controlled manually, electronically or electromechanically.

The chamber 3 may be pre-pressurised before the dispensation of the beverage commences. The gauge pressure in the chamber 3 at the end of the pre-pressurisation stage is in the range 0 to 45 kPa. A gauge pressure of 0 kPa equates to an absence of pre-pressurisation.

The pressure in the chamber may be increased as the beverage is dispensed. The peak pressure in the chamber 3 in the range 20 to 140 kPa. Alternatively the pressure in the chamber 3 can be arranged to remain constant or even fall as dispensation progresses.

These pressure ranges are only indicative of the pressures that the dispense head 2 can achieve and the specific pressures required will depend on the type of beverage dispensed, the temperature of the beverage and the type of head required. Experimentation with various pressures and pressure changes to achieve differing results is a straightforward matter, therefore the present invention should not be read as being restricted to the specific pressure ranges quoted.

The rate of dispensation of the beverage may also

be varied. The beverage is typically dispensed at the rate of one pint in 5 to 90 seconds. Preferably one pint of beverage would be dispensed in approximately 15 to 60 seconds. The rate of dispensation possible will depend on the type of beverage dispensed and the amount of turbulence generation desired.

The operating cycle may include a 'dwell time' wherein the beverage is left in the pressurised environment once dispensation is complete to allow the beverage to settle and thus minimise 'surging' of the beverage upon depressurisation. The dwell time is typically in the range 5 to 60 seconds.

The rate of depressurisation of the chamber 3 may be rapid or more controlled. If the rate of depressurisation is too slow there will be an unacceptable delay in delivering the finished beverage. If the rate of depressurisation is too fast there is the danger with some beverages of over-foaming (fobbing) leading to the loss of product, degradation in quality of the head formed and inaccuracies in the volume dispensed to the customer.

The time required to depressurise the chamber 3 is typically in the range 5 to 90 seconds. However the actual time required depends on the type of beverage dispensed and may conceivably lie outside this range. The present invention is not intended to be restricted to the depressurisation times quoted.

Manual control of the operating cycle is achieved by providing the chamber 3 with manual fluid inlet and outlet valves 9, 10 and a manual beverage inlet valve 8. A user of the dispense head 2 first inserts the

container 4 into the chamber 3, seals the chamber 3 opens the fluid inlet valve 9, by means of a conventional lever, to pre-pressurise the chamber 3 if required. A pressure gauge of either a digital or dial type is provided to measure and display the gauge pressure within the chamber 3. The user of the dispense head 2 closes the fluid inlet valve 9 when the desired pressure has been obtained within the chamber 3. The user then opens the beverage inlet valve 8 to dispense the beverage into the container 3. When dispensation is complete the user opens the fluid outlet valve 10 to depressurise the chamber 3. Preferably the fluid outlet valve 10 is of a type which allows control of the volume flow rate of fluid passing there through. The chamber 3 is then opened and the container 4 and beverage withdrawn. The operating cycle may be controlled and varied manually by altering the peak pressure within the chamber, the volume flow rate of beverage dispensed, the dwell time and the volume flow rate of fluid outlet during the depressurisation stage. Disadvantages of manual control of the dispensation cycle include inconsistency of operation between operation cycles, training of the user is required for successful operation, there is no adjustment for beverage temperature and the user must be present during the entire operating cycle.

Electronic control of the operating cycle and operating conditions involves the use of a micro controller unit 130. The beverage inlet valve 8, fluid inlet valve 9 and fluid outlet valve 10 comprise electrical solenoids controlled by outputs from the micro controller 130. Inputs to the micro controller 130 comprise a combination of one or more of the

following: a pressure sensor, a beverage temperature sensor 132, a chamber temperature sensor, a weight sensor 134, a top-up switch 135, a pint/half pint switch 136 and a flow sensor 137. The micro controller 130 assesses its inputs and outputs controlling signals to the solenoids as required according to the micro controller's programming. The micro controller 130 may incorporate an EPROM (Erasable Programmable Read Only Memory) module containing the instruction set. This module may be easily reprogrammed in-situ to enable the dispense head 2 to dispense new lines of beverages as they come onto the market.

The pressure sensor 131 may comprise a pressure switch which simply detects when the pressure within the chamber 3 crosses a threshold level. The pressure switch then sends a signal to the micro controller 130. Alternatively the pressure sensor 131 comprises a sensor which measures the gauge pressure within the chamber 3. An advantage of a sensor which can measure a range of pressures is that the rate of fluid inflow/outflow from the chamber during pre-pressurisation/pressurisation/depressurisation can be made proportional to the instantaneous pressure in the chamber 3. Another advantage is that a number of pressure levels can be maintained in the chamber 3 if required for different stages of the dispensation cycle.

The beverage and chamber temperature sensors 132, 133 may comprise thermistors. Alternatively and where greater accuracy is required the sensors could comprise thermocouples. Preferably the beverage temperature sensor 132 is positioned in the beverage

inlet 5 as close to the dispensation nozzle as possible in order to minimise discrepancies between the measured and actual dispensation temperatures.

The weight sensor 134 comprises a strain gauge bridge created by strain gauges on two sides of a beam on which the container 4 is placed. The micro controller 130 tares the container 4 before dispensation of the beverage starts. Thus variability in the weight of the container 4 will not alter the weight of beverage dispensed.

The flow sensor 137 comprises a pelton wheel sensor. The pelton wheel sensor comprises a magnet on a wheel, the wheel being rotated by the flow of beverage passing the wheel. The rate of rotation of the wheel is thus proportional to the volume flow rate of beverage. A series of pulses are produced in a sensor as the magnet on the wheel rotates and the output of this sensor is used by the micro controller 130 to measure the flow rate of beverage. The micro controller 130 can thus measure the volume of beverage dispensed by integrating the volume flow rate over the time the beverage inlet valve 8 is open.

The top-up switch 135 and pint/half pint switch 136 comprise switches of a "keypad" variety which are manually operated by the user of the dispense head 2. The switches are connected to a printed circuit board which interfaces with the micro controller 130.

Electromechanical control of the operating cycle involves the use of electromechanical beverage inlet, fluid inlet and fluid outlet valves 8, 9, 10 instead of solenoids. The range of possible sensors is the as

described above for electronic control.

An advantage of electronic control and electromechanical control over manual control is that the operating cycle and conditions may be varied consistently, accurately and in line with feedback from the sensors provided.

For example it may be required to reduce the peak pressure within the chamber 3 if the beverage temperature increases. The electronic sensors, solenoids and micro controller provide an "adaptive" control system that can adapt to changes in the operating conditions between operating cycles and even changes during a single operating cycle.

Of the operating conditions which affect the resultant head formation one of the most important has been found to be the temperature of the beverage upon dispensation. Experiments show that the depth of head formed on the beverage can vary by approximately plus or minus 15 millimetres per °C change in beverage temperature. Therefore in order to accurately and consistently control the depth of the head formed on the beverage, it is necessary to control the temperature of the beverage that is dispensed.

Beverages dispensed in bars are often stored in cellars or in a below-bar location. The temperature in these locations is typically between 10°C and 14°C. The temperature of the bar where the beverages are actually dispensed is typically 18°C to 35°C. Consequently beverage in transit between the storage location and the point of dispensation is exposed to a wide range of temperatures. It is desired to maintain

the temperature of the beverage at the point of dispensation at a predetermined temperature within an allowable range. The allowable fluctuation in temperature of the beverage will depend on the type of beverage dispensed and the degree of "adaptive" control employed by the dispense head 2. Preferably the temperature of the beverage is held to within half a degree Celsius of a desired temperature. An example of a typical desired temperature range is 3.0°C plus or minus 0.5°C for a keg lager. Another possible desired range is 7.0°C plus or minus 0.5°C for an ale. The desired dispensation temperature will depend, amongst other things, on the season. There may be provided means for switching the dispensation temperature from a 'summer' setting to a 'winter' setting.

A further improved aspect of the present invention is a means of transporting the beverage between the storage point and the dispensation point. With prior art pipes or 'pythons' as shown in Figure 9, which are typically 30 metres or more in length, the beverage temperature is affected by the temperature of the environment through which the python passes. Figure 7 shows a 'cooled' python which allows beverage to be transported between the storage and dispensation points whilst maintaining the beverage at the required temperature. The python comprises a product flow tube 231 and a coolant flow tube 232. The coolant flow tube has an 'outward' section 233 running between a cooler 240 and a point near the dispense head 2 and an 'inward' section 234 which runs between a point near the dispense head 2 and the cooler 240. The outward and inward sections

233, 234 are connected at the end nearest the dispense head 2 such that coolant flowing along the outward section 233 is recirculated via the inward section 234 to the cooler 240. No coolant is lost from the system, thus saving on energy and cost and reducing potential pollution from discharged coolant. The coolant may be water provided by a line cooler or chilled glycol or any other suitable cooling medium. The product flow tube 231, as shown in Figure 8, runs co-axial with, and inside the outward section 233 such that the coolant flowing in the outward section 233 of the coolant flow tube 232 flows around the product flow tube 231 at all points, thereby cooling the beverage in the product flow tube 231. In addition, the python also comprises insulation 241 and an outer cover 242. The insulation 241 serves to insulate the relatively high temperature 'inward' section of the coolant flow tube 242 from the relatively low temperature 'outward' section of the coolant flow tube 232 and the product flow tube 231. The outer cover 242 serves to lend the python structural integrity and to protect it from damage. The python may also incorporate a service tube for the transport of pressurised gas to the dispense point.

The co-axial cooled python may be manufactured either by sliding one tube within another or by extruding the co-axial tubes in one piece. An extruded co-axial python may comprise strengthening ribs 243 between the product flow tubes 231 and the outward sections of the coolant flow tubes 233. The ribs help to maintain the flow path for coolant through the python, especially when the python is curved around corners.

The product flow tube 231 may in addition have circumferential ribs along its length. These increase the surface area of the tube 231 available for heat exchange with the coolant in the coolant flow tube 233. They also aid the bending flexibility of the python.

The product flow tube 231 and coolant flow tube 232 may be manufactured from MDPE (medium density polyethylene). In one embodiment of the present invention the product flow tube 231 has an external diameter of 9.5 mm and an internal diameter of 6.7 mm within an outward section of the coolant flow tube 233 having an external diameter of 18 mm and an internal diameter of 13 mm. Where there is only one product flow tube 231 in the python the inward section of the coolant flow tube 234 may have an external diameter of 9.5 mm and an internal diameter of 6.7 mm. Where there are three product flow tubes 231 in the python the inward section of the coolant flow tube 234 may have an external diameter of 18.0 mm and an internal diameter of 13.0 mm. THe layer of insulation 241 is typically approximately 13 mm thick.

The ability of the python of the present invention to maintain the beverage at the required temperature at which it leaves the cooler 240, especially at low temperatures, is much greater than in prior art arrangements, like that shown in Figure 9, where the product flow tube 231 and coolant flow tube 232 are juxtaposed so that they lie side by side within the python. The cooling of the product flow tubes 231 in prior art pythons is very variable and depends for

example on the packing arrangement of the python and the consequent distance of any product flow tube 231 from the coolant flow tube 232. The encapsulation of the product flow tube 231 in the coolant flow tube 232 provides consistent cooling of the beverage and a more efficient thermal coupling between the beverage and the coolant.

A temperature sensor 250 can be provided near the dispense head 2 to measure the temperature of the beverage either just before dispensation or just after. This information is relayed to a control means 251 which controls the quantity and/or degree of cooling of the coolant circulated in the coolant flow tube 232 by the cooler 240. In this way feedback is used to accurately control the dispense temperature of the beverage. Alternatively the temperature sensor 250 may be located remote from the dispensation point to monitor the temperature of the coolant in the inward section of the coolant flow tube 234 as it returns from the dispense point. If a good thermal coupling is established between the coolant flow tube 232 and the product flow tube 231 then the increase in temperature of the coolant will be indicative of the temperature decrease of the beverage in the product flow tube 231. An advantage of this arrangement is that the temperature sensor 250 is situated in the same location as the control means 251 and the sensor 250 is not in contact with the beverage during use, which is more hygienic and also reduces cleaning requirements.

The python may carry more than one type of beverage

and may service more than one dispense head 2. Each product flow tube 231 is within an outward section of a coolant flow tube 234. A single inward section of a coolant flow tube 234 is sufficient to recirculate the coolant back to the cooler 240 from each of the outward sections 233. The python may also comprise four product flow tubes or any other suitable number to service the required dispense tap apparatus. The python may also comprise a service line carrying pressurised gas from a cellar to the dispense head 2. The pressurised gas may then be used to pressurise the dispense head 2 as described above.

The cooler 240 may comprise an in line cooler of a conventional type, having for example 10 product flow coils therein. Beverage enters the cooler 240 at approximately 12°C where it is cooled in a water bath, leaving the cooler 240 at approximately 6°C. Thermal losses with a conventional python mean that the beverage arriving at the bar may be between 6 and 8°C. The actual temperature is very variable though and is influenced by amongst other things the rate of utilization of the cooler 240. If the throughput of beverage is high the beverage will not be cooled sufficiently. If no beverage has been dispensed for a period a portion of the beverage retained in the cooler 240 will become too cold. This can lead to unacceptable beverages being dispensed. These problems are overcome with the current invention by providing in connection with a cooled python as described above a cassette cooler 300, as shown in Figure 10. The cooler 300 comprises a water bath 301 through which a product coil 304 runs, a recirculation pump 302 and a

python connection 303. The cassette cooler 300 may be designed to be fitted in a conventional cooler 240 in place of one or more of the product coils. The product flow coil 304 may be designed to be of differing lengths in different cassettes. For instance, the product flow coil 304 may be 3 metres long, 15 metres or 18 metres in length. This is advantageous in that differeing degrees of cooling can be achieved. Beverage enters the cassette cooler 300 at approximately 12°C and is cooled to approximately 3°C. Other temperatures of beverage may be selected. The beverage is then transported through the product flow tube 231 of the cooled python. The coolant in the coolant flow tube 232 of the python is supplied from the water bath of the cassette cooler 300 and is pumped by means of its own recirculation pump 302. An advantage of the cassette cooler 300 is that beverage is cooled to a lower temperature than with conventional coolers. A second advantage is that, since the beverage is transported in a cooled python, the beverage reaches the bar at the same temperature at which it left the cooler 300. A third advantage is that, since the coolant in the cooler 300 is at approximately 2°C, the beverage can not be significantly over-cooled during periods of low utilization. Thus a more consistent beverage temperature is produced.

Figure 11 shows an alternative cooler 310 capable of cooling more than one product flow tube 231. Typically three tubes 231 may be cooled.

Claims

1. Apparatus for dispensing a beverage into a container, the apparatus comprising a chamber; beverage inlet means in communication with the chamber; fluid inlet means in communication with the chamber; and fluid outlet means in communication with the chamber; wherein the chamber is pressurisable before and/or during dispensation of the beverage.

2. Apparatus as claimed in claim 1 wherein the chamber is pressurisable before and/or during dispensation of the beverage by means of fluid influx through the fluid inlet means.

3. Apparatus as claimed in claim 2 wherein the chamber comprises a body portion, having an aperture therein for receiving therethrough the container; a base; and a door movable from a first position in which the aperture is open to a second position in which the aperture is closed; the body portion, base and door in the second position defining a closed volume within the chamber; wherein the chamber is pressurisable by influx of fluid into the volume.

4. Apparatus as claimed in claim 3 wherein the fluid is a gas.

5. Apparatus as claimed in claim 4 wherein the gas is ambient air.

6. Apparatus as claimed in claim 4 wherein the gas is nitrogen, carbon dioxide or nitrous oxide.

7. Apparatus as claimed in claim 4 wherein the gas

is a mixture of two or more of the following: ambient air, nitrogen, carbon dioxide and nitrous oxide.

8. Apparatus as claimed in any of claims 4 to 7 wherein the gas is pumped into the chamber.

9. Apparatus as claimed in claim 3 wherein the fluid is a liquid.

10. Apparatus as claimed in claim 9 wherein the liquid is water.

11. Apparatus as claimed in either claim 9 or claim 10 wherein the volume comprises a secondary chamber in fluid communication with the chamber; wherein the chamber is pressurisable by the influx of liquid into the secondary chamber.

12. Apparatus as claimed in claim 11 wherein the secondary chamber surrounds a portion of the chamber.

13. Apparatus as claimed in any of claims 3 to 12 wherein the chamber comprises sealing means between the door and the body portion.

14. Apparatus as claimed in claim 13 wherein the sealing means comprises a gasket between an external face of the door and an internal face of the body portion.

15. Apparatus as claimed in claim 14 wherein the gasket is rubber.

16. Apparatus as claimed in claim 14 wherein the gasket is polymer.

17. Apparatus as claimed in any of claims 3 to 16 wherein the body portion comprises a transparent window.

18. Apparatus as claimed in claim 17 wherein the window is toughened glass.

19. Apparatus as claimed in claim 17 wherein the window is polycarbonate.

20. Apparatus as claimed in any of claims 17 to 19 wherein the window comprises etchings.

21. Apparatus as claimed in any of claims 3 to 20 wherein the body portion comprises retaining means for retaining the door in the second position during dispensation of the beverage.

22. Apparatus as claimed in any of claims 3 to 21 wherein the body portion comprises substantially vertical runners; the door being movable along the runners from the first position in which the door is lowermost to the second position in which the door is uppermost in sealing engagement with the body portion.

23. Apparatus as claimed in claim 22 wherein the door comprises an aluminum frame surrounding a polycarbonate panel.

24. Apparatus as claimed in any of claims 3 to 21 wherein the door comprises a flat external face and a ribbed internal face; the door being flexible from the first position in which the door is sealed against the body portion and the second position in which the door is distorted into the chamber to open the aperture.

25. Apparatus as claimed in claim 24 wherein the door is joined to the body portion along a vertical edge of the door such that the door is flexible in a horizontal plane.

26. Apparatus as claimed in claim 24 or claim 25 wherein the door comprises reinforcing bars within ribs of the ribbed internal face.

27. Apparatus as claimed in any of claims 24 to 26 wherein the door is a plastic extrusion.

28. Apparatus as claimed in any of claims 3 to 21 wherein the door is rotatable about a central vertical axis of the body portion from the first position to the second position.

29. Apparatus as claimed in claim 28 wherein the body portion comprises circumferential runners; the door sliding along the runners from the first position to the second position.

30. Apparatus as claimed in claim 28 or claim 29 wherein the door comprises an aluminum frame surrounding a polycarbonate panel.

31. Apparatus as claimed in any of claims 22 to 30 wherein edge portions of an external face of the door seal against an internal face of flange extensions of the body portion when the door is in the second position.

32. Apparatus as claimed in any of claims 22 to 31 wherein the door comprises a handle.

33. Apparatus as claimed in claim 1 wherein the chamber comprises a body portion, having an aperture therein for receiving therethrough the container; a base; an internal portion movable from a first position in which the aperture is open to a second position in which the aperture is closed; and a piston located within the internal portion; the body portion, base, internal portion in the second position and piston defining a closed volume within the chamber; wherein the chamber is pressurisable by movement of the piston.

34. Apparatus as claimed in claim 33 wherein the internal portion comprises a cylinder of smaller diameter than the body portion and axially aligned therewith; the piston located within the cylinder; wherein the cylinder is axially movable relative to the body portion from the first position in which the cylinder is below the level of the aperture to the second position in which the cylinder is sealed against a top portion of the body portion closing the aperture.

35. Apparatus as claimed in claim 34 wherein the cylinder comprises a circumferential circlip; the piston comprises an O-ring in rolling sealing engagement with the cylinder; and a compression spring is located between the circlip and the piston such that as the piston is moved upwardly in the chamber the cylinder is forced upwardly into the second position.

36. Apparatus as claimed in claim 35 wherein the top portion of the body portion comprises a rubber seal

against which the cylinder seats in the second position.

37. Apparatus as claimed in any of claims 33 to 36 wherein the piston is coupled to gearing means and a lever.

38. Apparatus as claimed in any of claims 33 to 37 wherein the piston is coupled to an electric ram.

39. Apparatus as claimed in claim 1 wherein the chamber comprises the container; and the chamber is pressurisable by influx of fluid into the container.

40. Apparatus as claimed in claim 39 wherein the beverage inlet means; fluid inlet means; and fluid outlet means are coupled to the container by means of a manifold.

41. Apparatus as claimed in any preceding claim wherein the beverage inlet means comprises a beverage inlet valve; the fluid inlet means comprises a fluid inlet valve; and the fluid outlet means comprises a fluid outlet valve.

42. Apparatus as claimed in claim 41 wherein the beverage inlet valve, fluid inlet valve and fluid outlet valve comprise manual valves.

43. Apparatus as claimed in claim 41 wherein the beverage inlet valve, fluid inlet valve and fluid outlet valve comprise electrical valves.

44. Apparatus as claimed in claim 43 wherein the beverage inlet valve, fluid inlet valve and fluid

outlet valve comprise electrical in-line solenoid valves.

45. Apparatus as claimed in claim 41 wherein the beverage inlet valve, fluid inlet valve and fluid outlet valve comprise electromechanical valves.

46. Apparatus as claimed in claim 41 wherein the beverage inlet valve, fluid inlet valve and fluid outlet valve comprise pneumatic valves.

47. Apparatus as claimed in claim 41 wherein the fluid outlet valve comprises the seal between the door and the body portion of the chamber.

48. Apparatus as claimed in any preceding claim wherein the beverage inlet means comprises a smooth flow stainless steel dispense tap.

49. Apparatus as claimed in any of claims 1 to 47 wherein the beverage inlet means comprises turbulence generating means.

50. Apparatus as claimed in claim 49 wherein the turbulence generation means comprises an orifice plate.

51. Apparatus as claimed in claim 49 wherein the turbulence generation means comprises means for injecting a secondary flow of beverage into the beverage in the beverage inlet means.

52. Apparatus as claimed in claim 49 wherein the turbulence generation means comprises means for injecting a flow of gas into the beverage in the

beverage inlet means.

53. Apparatus as claimed in claim 49 wherein the turbulence generation means comprises a fluidic valve.

54. Apparatus as claimed in claim 49 wherein the turbulence generation means comprises means for vibrating a dispense nozzle of the beverage inlet means at high frequencies.

55. Apparatus as claimed in claim 54 wherein the means for vibrating the dispense nozzle comprises an piezo-electric transducer coupled to the dispense nozzle; wherein the piezo-electric transducer expands and contracts in response to electrical signals to cause the dispense nozzle to vibrate.

56. Apparatus as claimed in claim 54 or claim 55 wherein the dispense nozzle is vibrated at ultrasonic frequencies.

57. Apparatus as claimed in any preceding claim wherein the beverage inlet means comprises a single dispense nozzle.

58. Apparatus as claimed in any of claims 1 to 56 wherein the beverage inlet means comprises a multiplicity of dispense nozzles.

59. Apparatus as claimed in any preceding claim further comprising a metering means for accurately dispensing known volumes of beverage.

60. Apparatus as claimed in claim 59 wherein the metering means is located in the beverage inlet means.

61. Apparatus as claimed in claim 60 wherein the metering means comprises a positive displacement pump.

62. Apparatus as claimed in claim 60 wherein the metering means comprises a turbine meter.

63. Apparatus as claimed in claim 59 wherein the metering means comprises a weight sensor that determines the weight of beverage dispensed.

64. Apparatus as claimed in claim 59 wherein the metering means comprises a pressure sensor that determines the change in pressure of the chamber as the beverage is dispensed.

65. Apparatus as claimed in claim 59 wherein the sensing means comprises one or more photo-electric diodes arranged transversely across the chamber.

66. Apparatus for inducing turbulence in a flow of beverage comprising a piezo-electric transducer coupled to a dispense nozzle; wherein the piezo-electric transducer expands and contracts in response to electrical signals to cause the dispense nozzle to vibrate.

67. A method of dispensing a beverage comprising the steps of: inserting a container into a chamber through an aperture; closing the aperture to seal the chamber; pressurising the chamber to a known pressure before dispensing the beverage; dispensing the beverage; depressurising the chamber; and opening the aperture to allow the container and beverage to be removed.

68. A method of dispensing a beverage comprising the

steps of: inserting a container into a chamber through an aperture; closing the aperture to seal the chamber; dispensing the beverage thereby causing the pressure in the chamber to increase; depressurising the chamber; and opening the chamber to allow the container and beverage to be removed.

69. A method of dispensing a beverage as claimed in claim 67 or 68 wherein the chamber is pressurised by the influx of fluid.

70. A method of dispensing a beverage as claimed in claim 69 wherein the fluid is a gas.

71. A method of dispensing a beverage as claimed in claim 70 wherein the gas is ambient air.

72. A method of dispensing a beverage as claimed in claim 70 wherein the gas is nitrogen.

73. A method of dispensing a beverage as claimed in claim 70 wherein the gas is a mixture of two or more of the following: ambient air, carbon dioxide, nitrogen and nitrous oxide.

74. A method of dispensing a beverage as claimed in claim 67 or claim 68 wherein the chamber is pressurised by movement of a piston.

75. A method of dispensing a beverage as claimed in claim 67 wherein the chamber is pre-pressurised to a pressure in the range 0 to 45 kPa.

76. A method of dispensing a beverage as claimed in any of claims 67 to 75 wherein the chamber is pre-

pressurised to a pressure in the range 10 to 30 kPa.

77. A method of dispensing a beverage as claimed in any of claims 67 to 76 wherein the chamber is pressurised to a pressure in the range 20 to 140 kPa.

78. A method of dispensing a beverage as claimed in any of claims 67 to 76 wherein the beverage is dispensed at a temperature in the range 2 to 10 degrees Celsius.

79. A method of dispensing a beverage as claimed in any of claims 67 to 78 wherein the beverage is dispensed at a temperature in the range 3 to 6 degrees Celsius.

80. A method of dispensing a beverage as claimed in any of claims 67 to 79 wherein the beverage is dispensed at a temperature within half a degree Celsius of a known temperature.

FIG. 1.

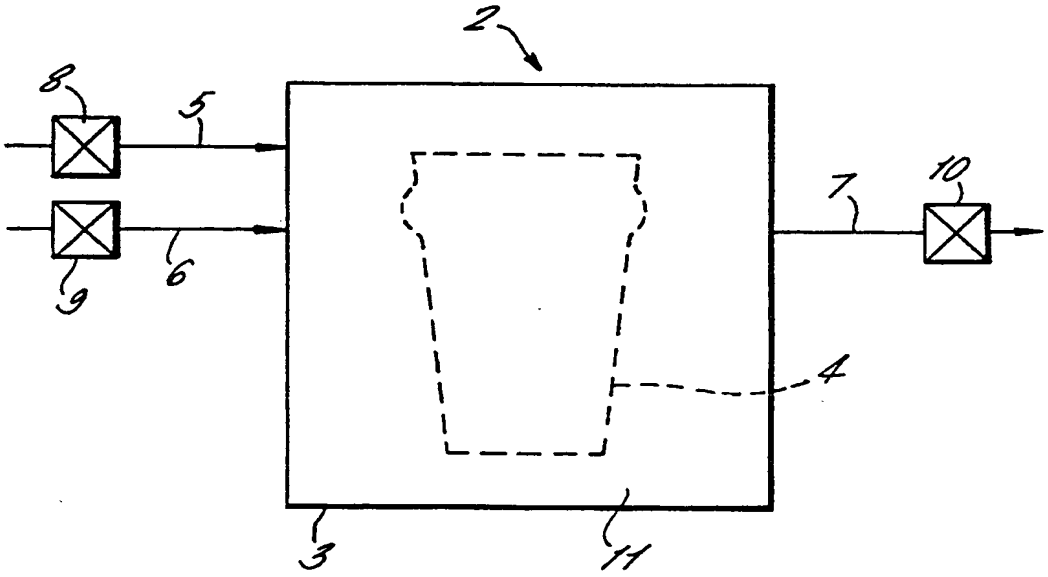


FIG. 2a.

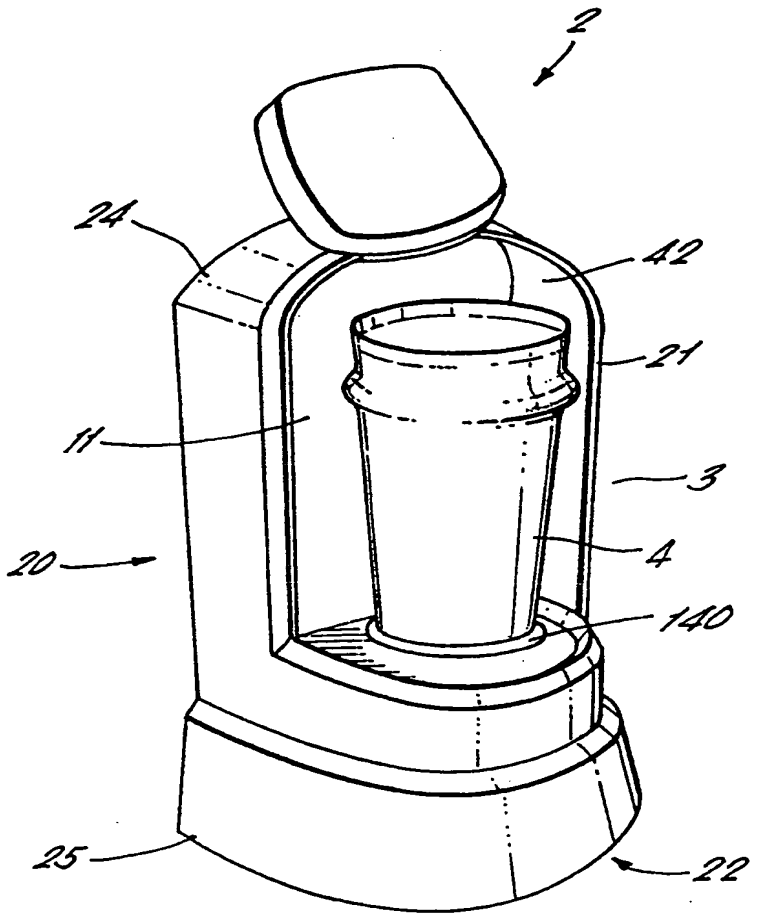


FIG. 2b.

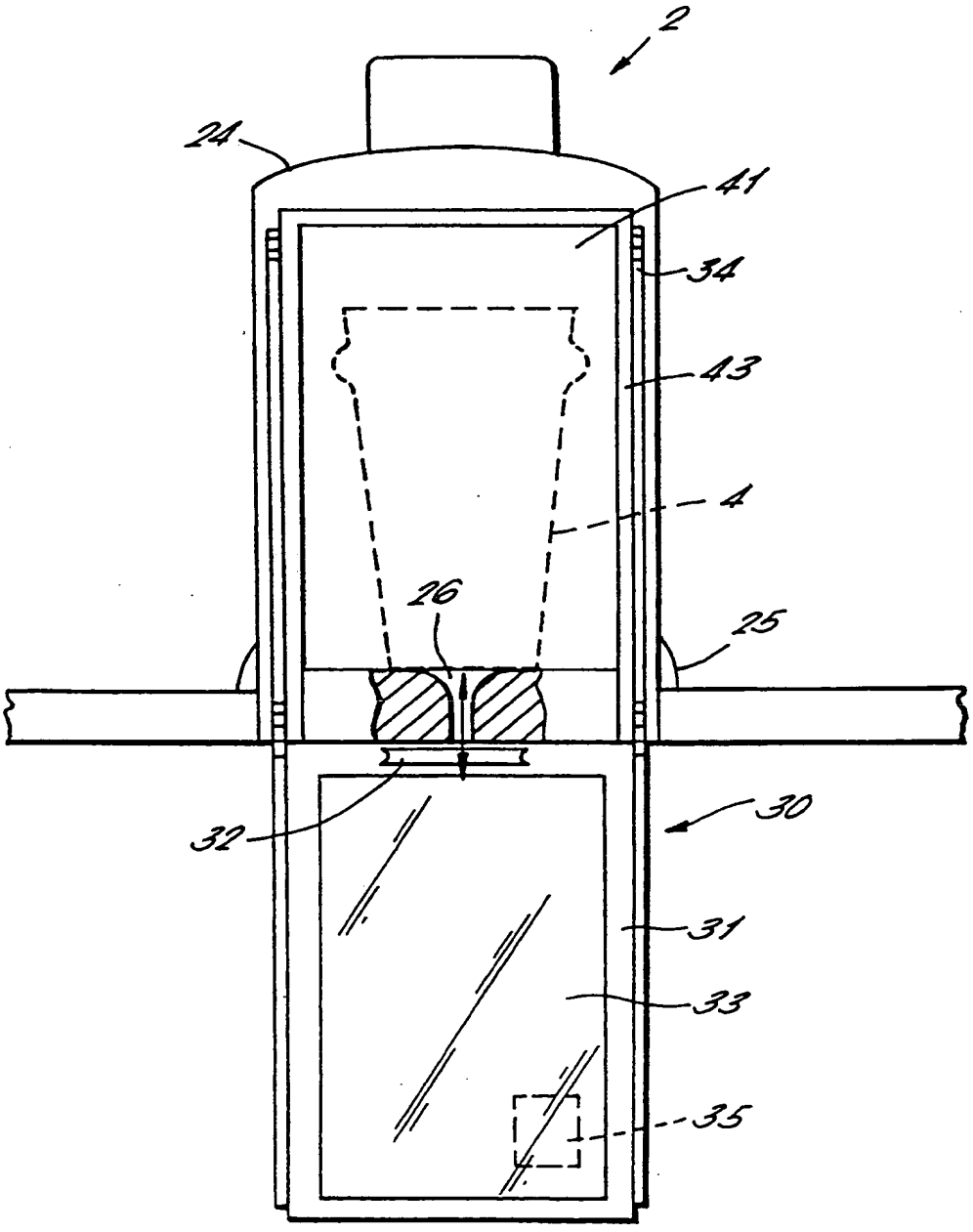


FIG. 3a.

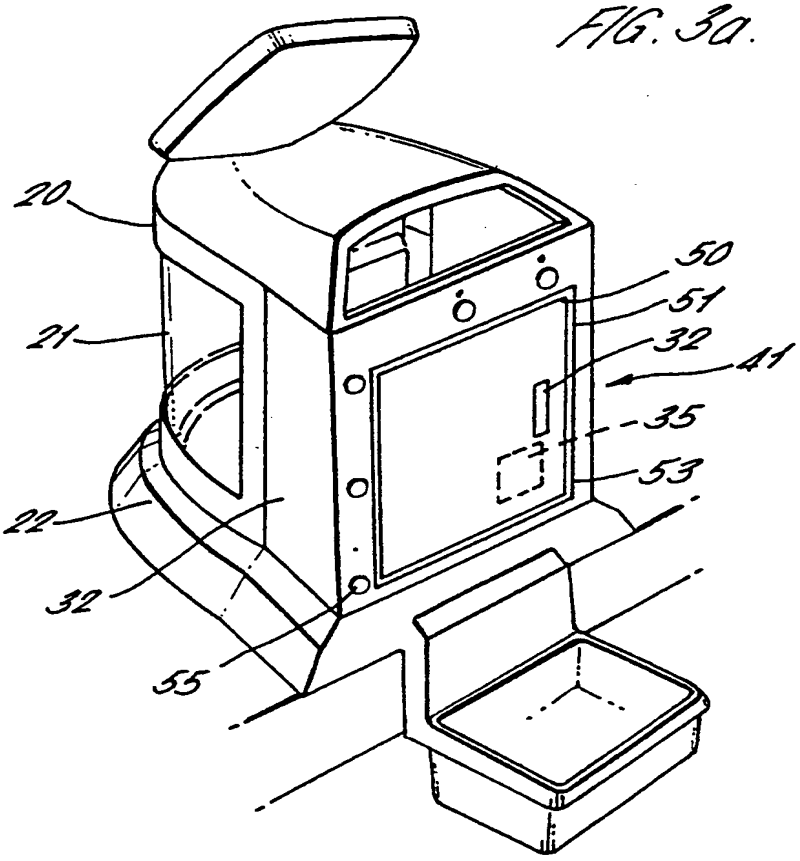


FIG. 3b.

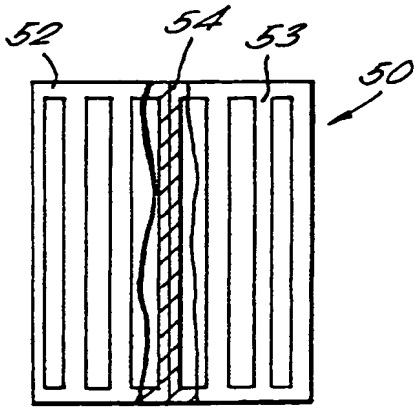


FIG.4.

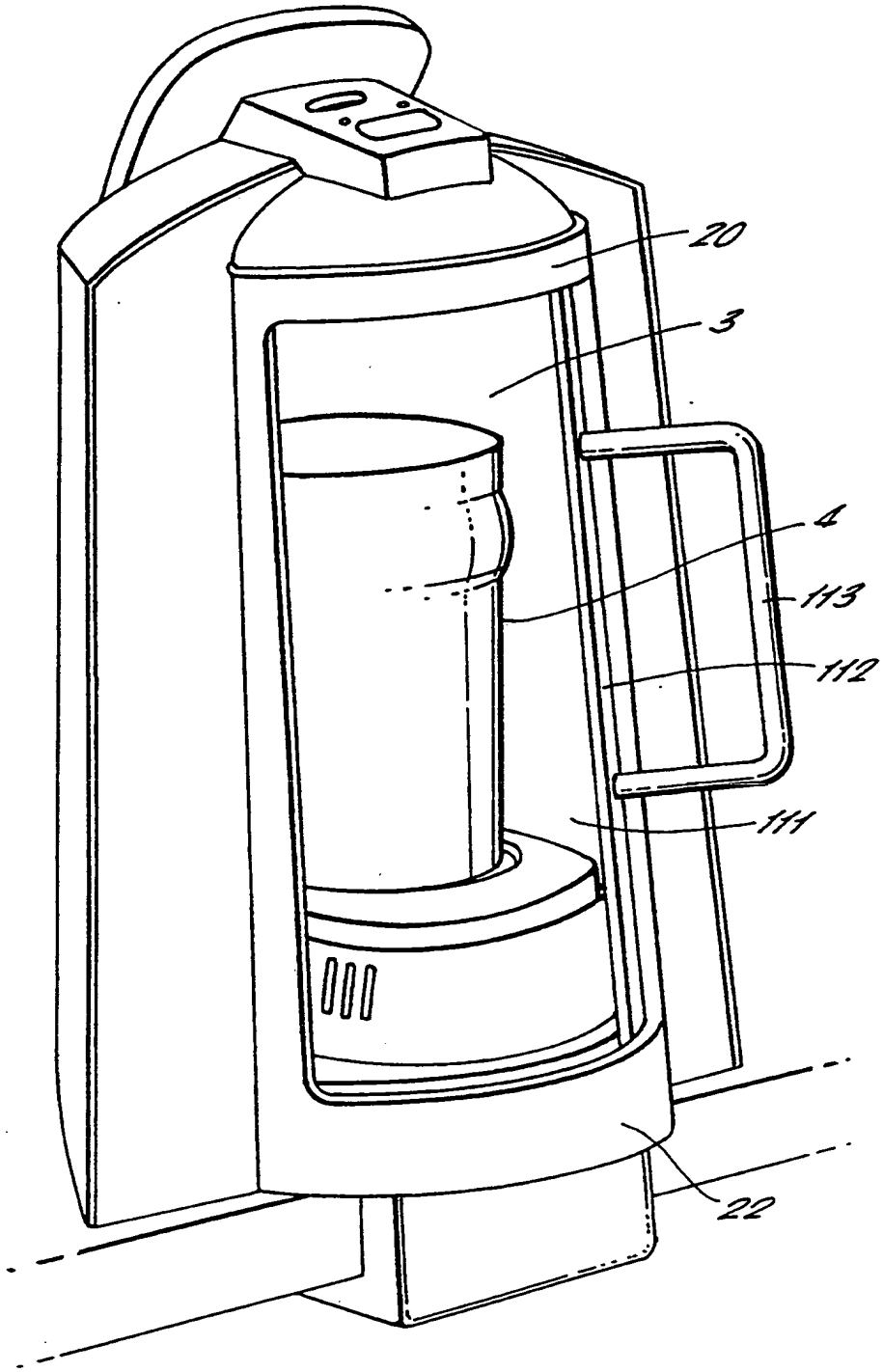
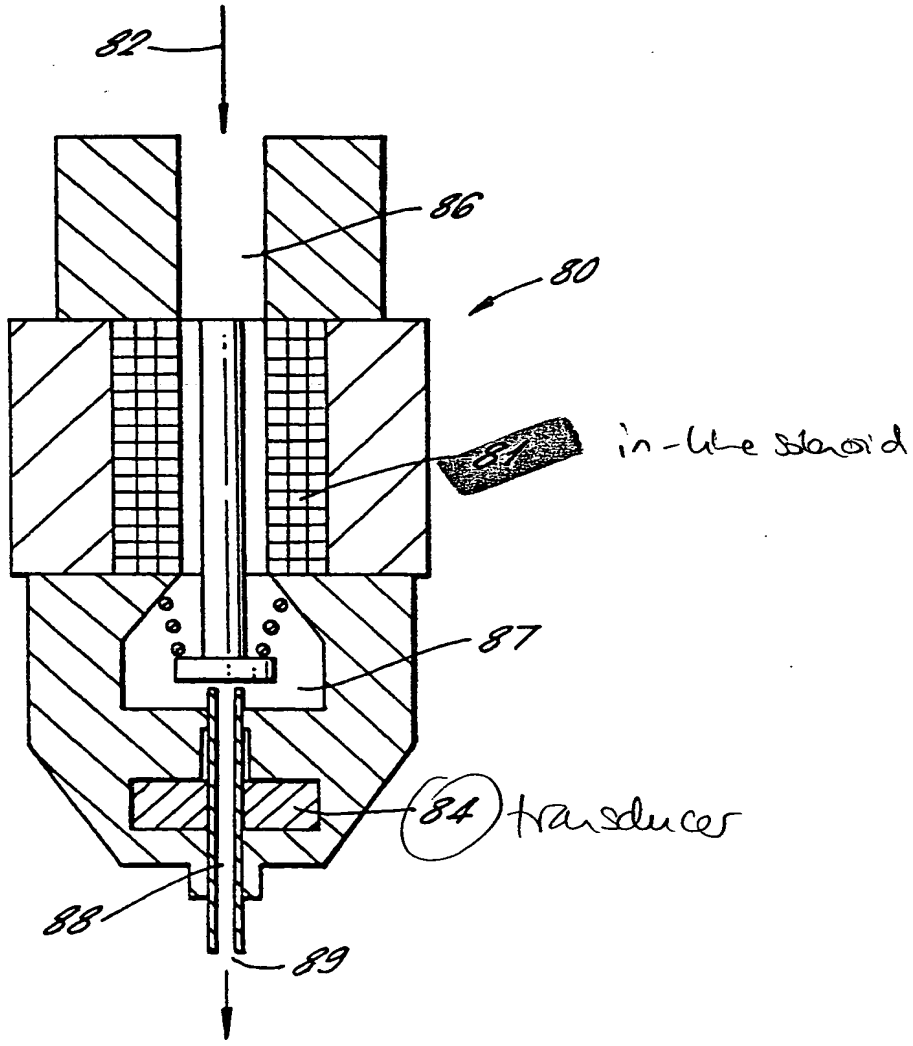


FIG. 5a.



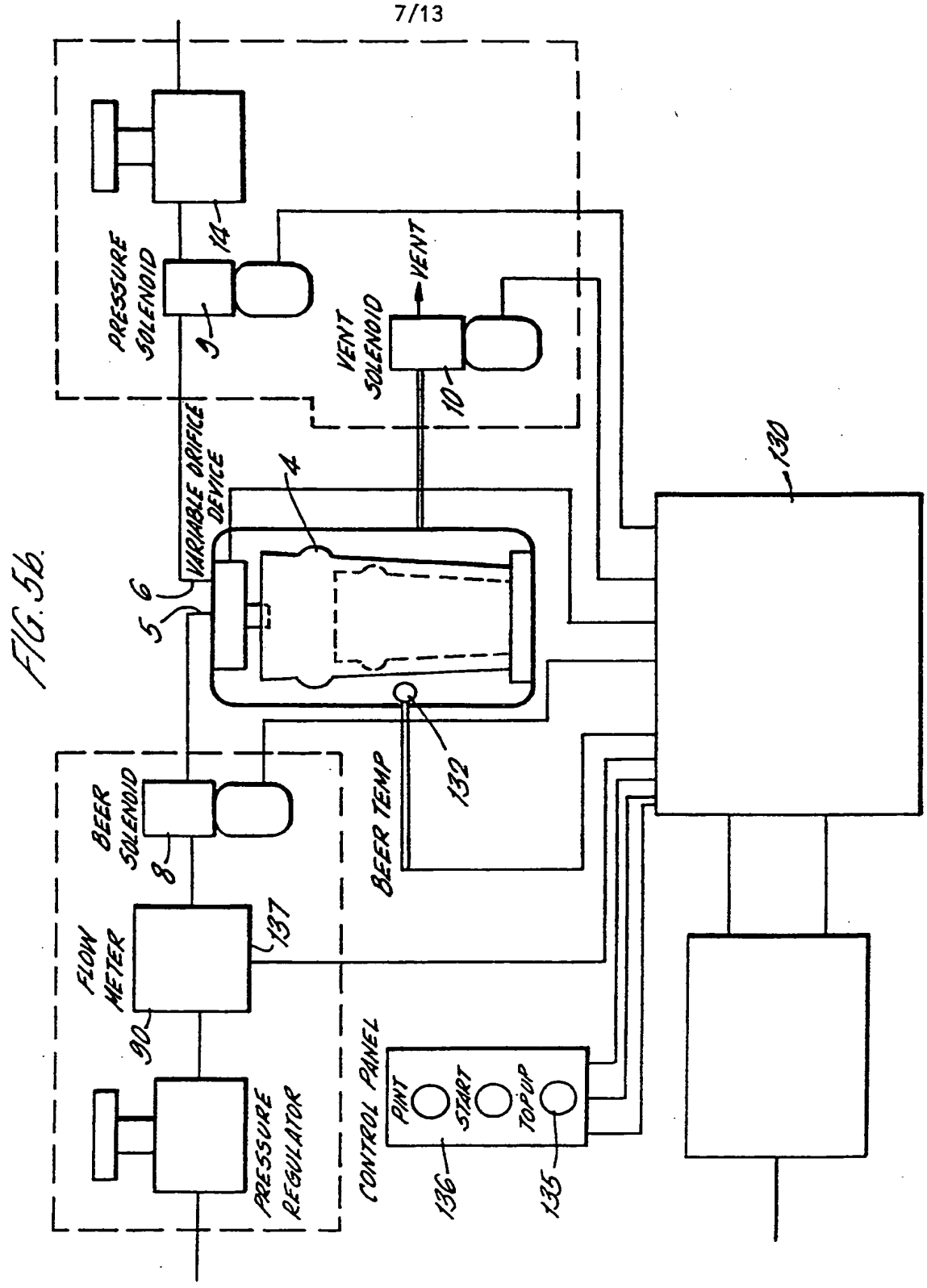

PRESSURE SOLENOID
14
9
VENT SOLENOID
VENT
10
VARIABLE ORIFICE DEVICE
4
5
6
130
BEER SOLENOID
8
BEER TEMP
132
FLOW METER
137
90
CONTROL PANEL
PINT
START
TOPUP
136
135
PRESSURE REGULATOR

FIG. 5b.

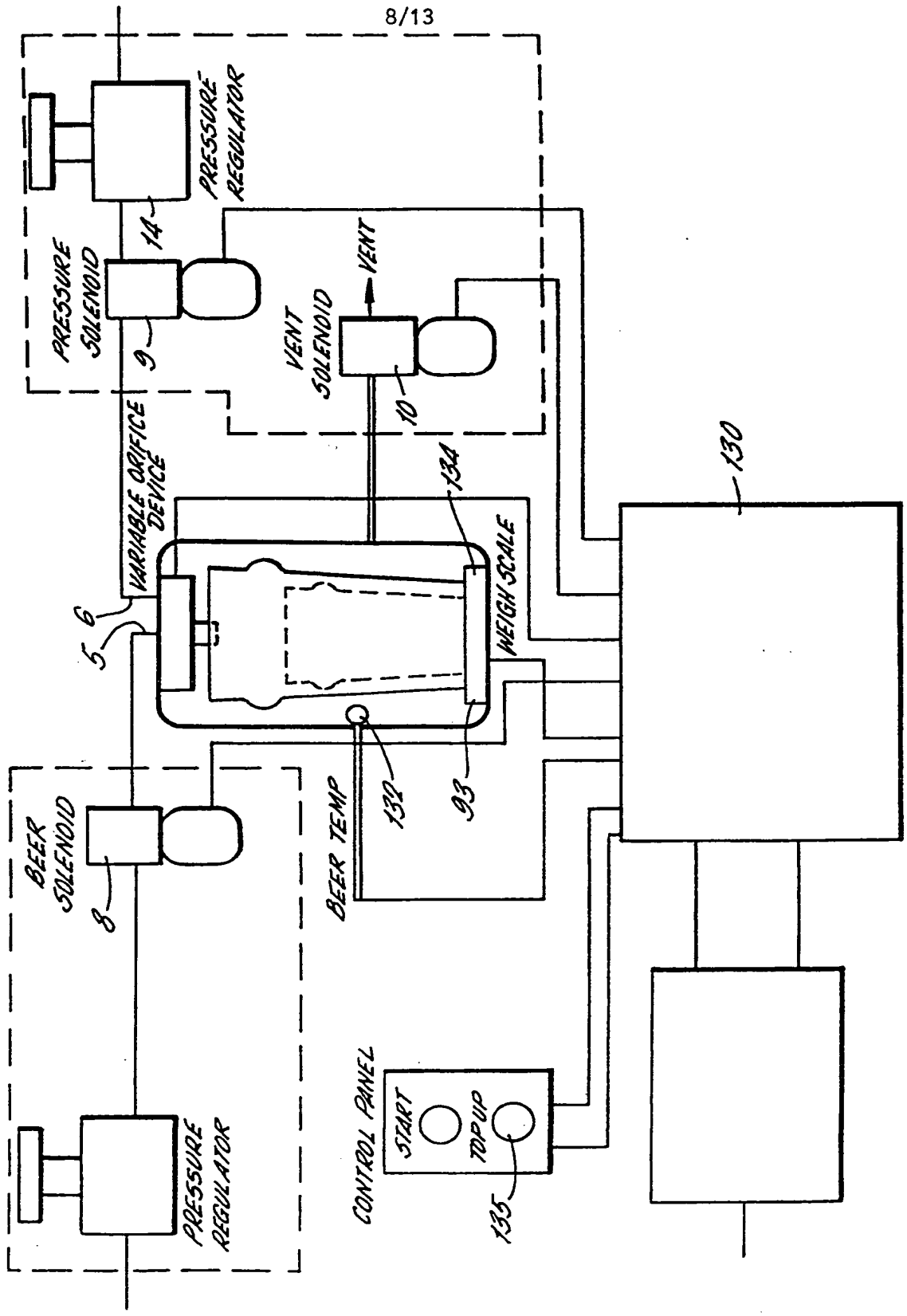

PRESSURE REGULATOR
14
PRESSURE SOLENOID
9
VENT
VENT SOLENOID
10
130
134
VARIABLE ORIFICE DEVICE
6
5
WEIGH SCALE
BEER SOLENOID
8
BEER TEMP
132
93
CONTROL PANEL
START
TOPUP
135
PRESSURE REGULATOR

FIG. 5C.

FIG. 6.

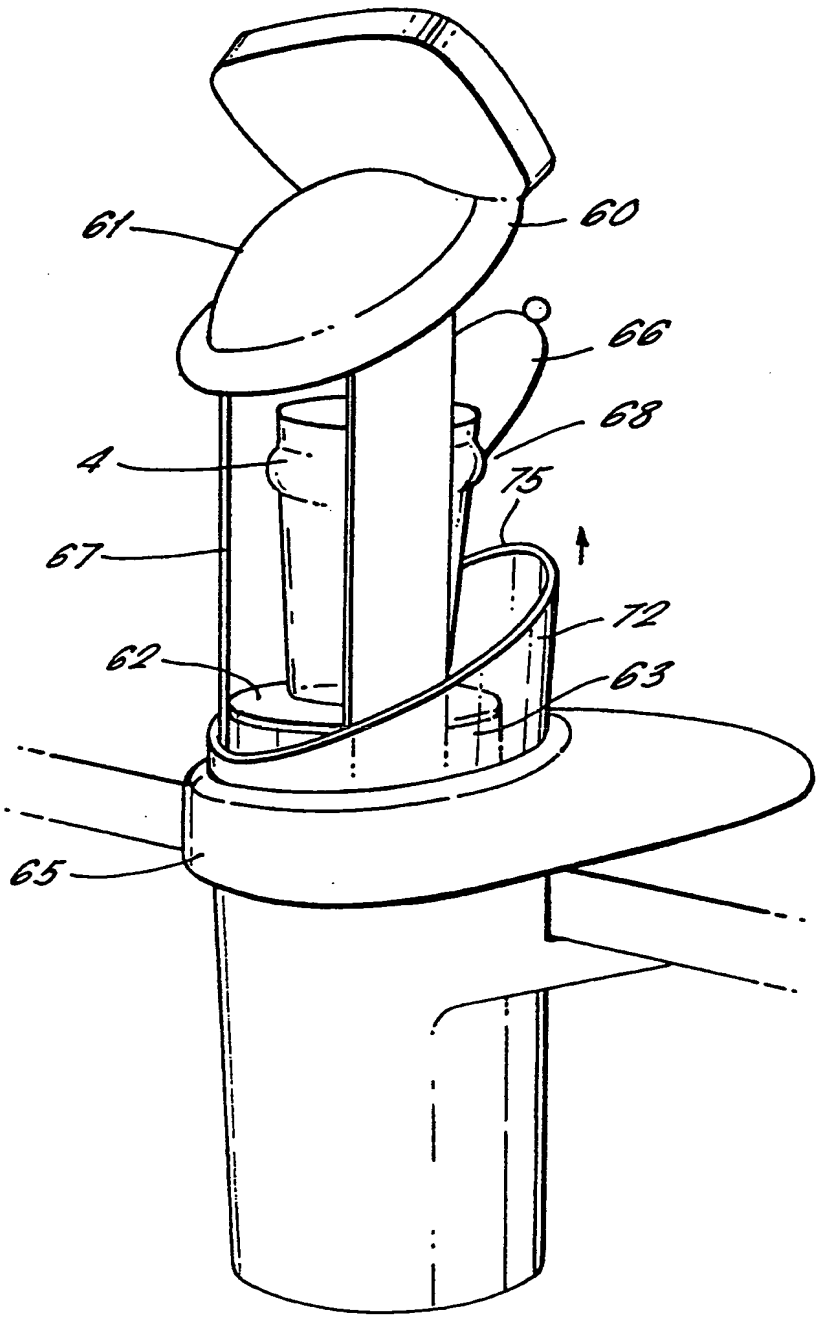


FIG. 7.

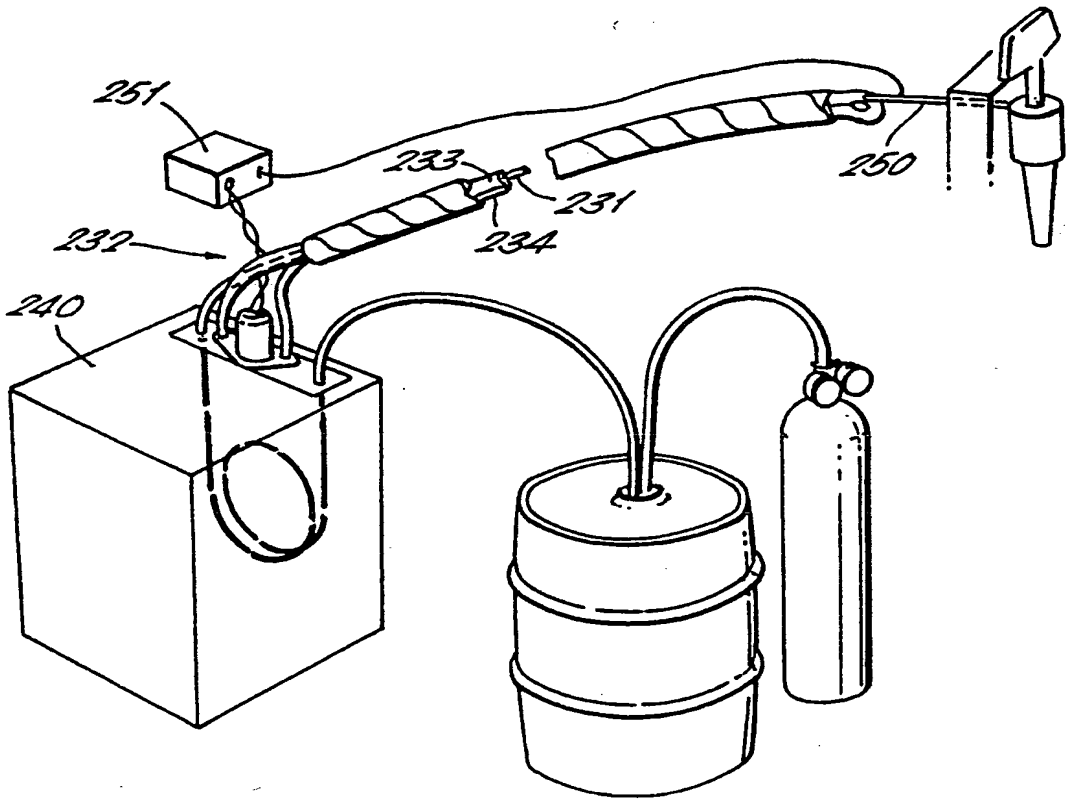


FIG. 8.

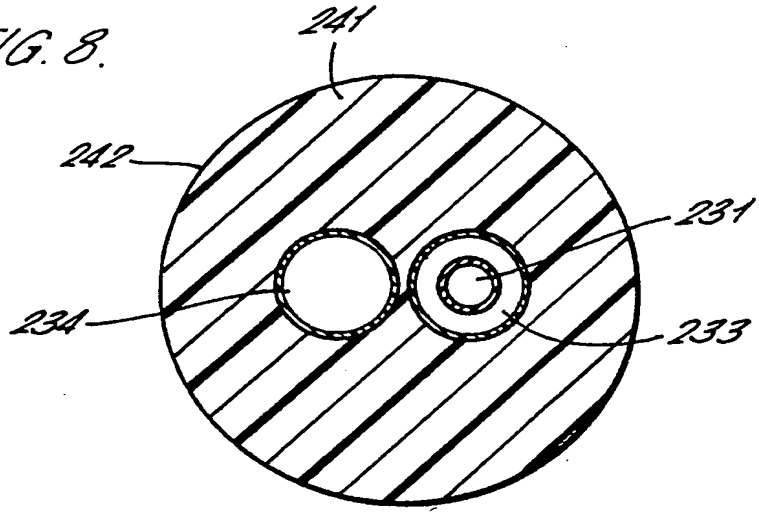


FIG. 9.

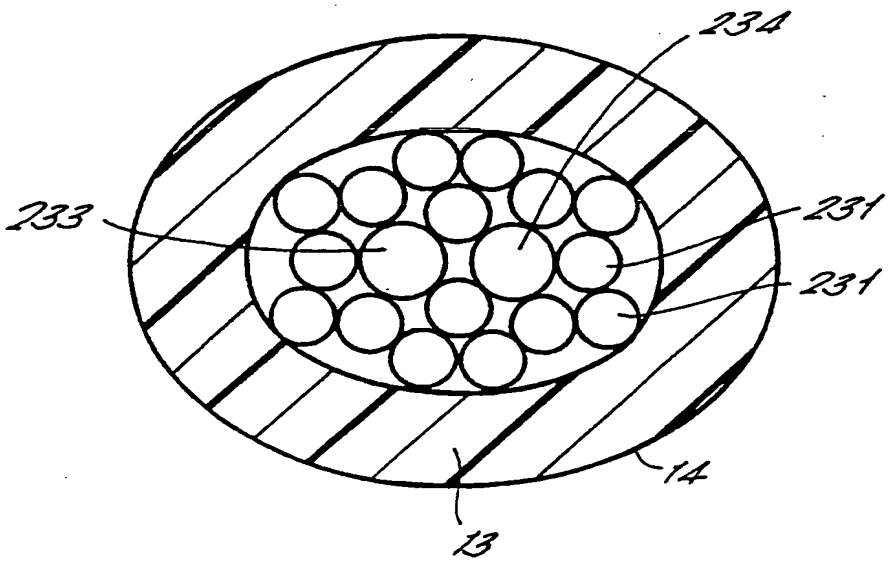


FIG. 10.